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Taxation, Wages and Employment in a Unionized Economy

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I. INTRODUCTION

The role of taxation in the process of wage formation has recently gained interest in the macroeconomic literature. Attention has been drawn on the tax push inflation argument, e.g. by Knoester and Van der Windt (1987) and by Malcomson and Sartor (1987). An increase in taxation would, according to this view, lead to claims for higher gross wages by unions.

In highly unionized and small open economies, such as Belgium, an expansion of the public sector could therefore harm the stability of the economy if the resulting increase in taxation would be shifted forward by unions into higher wages. The competitive position would consequently deteriorate and unemployment would rise. A tax-wage spiral would consequently develop and destabilize the economy.

It is the purpose of this paper to incorporate tax shifting in a wage bargaining framework. In addition to income taxes and social security contributions paid by union members, a payroll tax will be introduced as well. The resulting wage equation will be estimated simultaneously with a labour demand equation. The degree of tax shifting will then show up in the parameter estimates of the model.

Since the emphasis of this paper lies on the tax shifting behaviour, changes in the tax structure, e.g. through changes in the progressivity

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of the income tax, will not be examined here. For a recent theoretical treatment of the latter, see Hersoug (1984).

The approach followed in this paper differs from the existing tax push models by the explicit formulation of a wage bargaining set-up which will be of the Nash type. The models referred to above, such as the one estimated by Malcomson and Sartor (1987) do not allow for wage bargaining. Instead, the union sets the wage level in a utility maximizing way whereas the firm determines the level of employment on the labour demand function, given the wage chosen by the union. This view on wage determination does not receive support from the institutional labour economists who stress the bargaining aspects in the wage determination process. An operational solution derived from a set of plausible axioms is obtained with the Nash bargaining model. This model has a strong appeal because of the implied rational behaviour by the parties involved. It also allows for the introduction of specific variables into the wage equation, such as the payroll tax rate and profits which differentiate this approach from the monopoly union case.

II. THE THEORETICAL MODEL

A. *The Union*

There are M identical workers in the economy which are either employed or unemployed. The preferences of an employed worker are assumed to be represented by a quasi-concave utility function u which has as arguments: the yearly real net of tax wage augmented with real social security benefits other than unemployment compensation and public goods G. The latter are represented by public investment. (See also Sampson (1983) for a similar treatment).

$$u = u(y, G) \tag{1a}$$

$$y = \frac{h\omega\ (1-t_1) + s}{Pc} \tag{1b}$$

where:
- ω: the gross hourly wage,
- t_1: the income tax rate, inclusive of social security contributions,
- s: social security benefits other than unemployment compensation,
- Pc: the consumer price index,

h: hours worked per year,
y: real wage and transfer income,
G: public investment.

Note that social security benefits are for simplicity treated as exempted from taxation. Furthermore, marginal utility of income and of public goods is assumed positive and decreasing, i.e. $u_y > O$, $u_{yy} < O$, $u_G > O$, $u_{GG} < O$. Complementarity between private income and public goods implies $u_{yG} > O$, whereas substitutability leads to $u_{yG} < O$.

Unemployed workers receive real unemployment benefits b which are tax exempt. The utility function of an unemployed worker can then be written as:

$$u\ (b,\ G) \tag{2}$$

with $u_b > O$, $u_{bb} < O$ and $u/bG \lesseqgtr O$.

The objective function U of the union is assumed to be of the utilitarian form, i.e. it is a weighted average of the utility of the employed and of the unemployed workers. The weights are respectively the probability of being employed and unemployed. This specification of the union objective function has been widely used in the literature (see e.g. Oswald (1982), Van Rompuy and De Bruyne (1980)). It can also be interpreted as the expected utility of a representative union member who does not know the probability of being employed or not before a wage contract has been settled. Let total employment in the private sector be denoted by Lp and public employment by Lg, then:

$$U = \frac{Lp + Lg}{M} u\ (y,\ G) + \frac{M - (Lp + Lg)}{M} u\ (b,\ G) \tag{3}$$

Note that the weights in (3) are variable since private employment will depend on the wage cost to the firm. Public employment is assumed to be dependent on political decisions and is treated in an exogenous way in the sequel.

The marginal utility to the union of a wage increase can be derived from (3) and (1a), assuming that hours are determined exogenously:

$$U_\omega = \frac{1}{M} \left\{ \epsilon \frac{Lp}{\omega} [u\ (y,\ G) - u\ (b,\ G] + (Lp + Lg)\ w_y\ h \frac{(1-t_1)}{Pc} \right. \tag{4}$$

In the expression between brackets, ϵ denotes the wage elasticity of private employment. The first term in this expression contains the utility differential between an employed and unemployed worker. It corresponds to the utility loss (since $\epsilon < O$) resulting from a wage increase and a subsequent reduction in employment. The second term refers to the utility gain of the employed workers. In the case of a monopoly union, the wage would be chosen so as to maximize (3). The optimal wage would therefore balance the marginal utility gain and the marginal utility loss of a wage increase since, in order to obtain an interior maximum $U_\omega = O$. It is obvious that as the elasticity of private employment increases, the optimal wage will be reduced. The optimal wage will be higher as the share of the wage inelastic public employment in total employment increases.

B. *The Firm*

Private output X is produced in identical firms using private labour Lp, imported materials and energy Z and the stock of capital K. The latter is treated as exogenous whereas imported materials and energy are bought at a price Pz.

The profit maximizing level of employment can be written as:

$$Lp = Lp\left(\frac{w}{P}, \frac{Pz}{P}, K\right) \qquad (5)$$

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where w is the yearly wage cost per worker:

$$w = \frac{h\omega\ (1+t_2)}{P} \qquad (6)$$

and: t_2 = rate of employer's social security contributions,
P = price of output,
Pz = price of imported materials and energy,
K = real stock of private capital.

Note that the sign of P_z/P depends upon the complementarity (negative) or substitutability (positive) relationship between Z and L^p.

C. *The cooperative Nash Solution*

Wage contracts are negotiated between the union and the firm. In the model outlined here, the wage rate ω, i.e. the gross hourly wage will be settled in the wage contract. It will furthermore apply to the public sector as well.

In the Nash solution, the optimal wage will result from the maximization of the following product Ω:

$$\Omega = (U - \bar{U})^{\gamma} (\pi - \bar{\pi})^{1-\gamma} \qquad O \leqslant \gamma \leqslant 1 \tag{7}$$

The parameter γ denotes the bargaining strength of the union. If $\gamma = 1$, the bargaining solution reduces to a monopoly union solution. If on the other hand $\gamma = 0$, the resulting wage will maximize profits. The reference or threat points $\bar{U}$ and $\bar{\pi}$ play a crucial role in the Nash solution. They refer to the utility of the union and to the firm's profits in case of disagreement.

As for the union, disagreement implies a strike and loss of wage income. The utility function of the employed union member will therefore reduce to:

$$u\left(\frac{q + s}{Pc}, G\right) \tag{8}$$

where q denotes strike compensation. The utility differential for the union $U - \bar{U}$ can then be written, using (3) and (8)

$$U - \bar{U} = \frac{Lp + Lg}{M} [u(y, G) - u(\bar{y}, G)] \tag{9}$$

where:

$$\bar{y} = \frac{q + s}{Pc} \tag{10}$$

As for the firm, disagreement implies a production stop. In the short run however, fixed costs F have to be borne. Denote profits by π:

$$\pi = pX - (wLp + PzZ + F) \tag{11}$$

The profit differential reduces to:

$$\pi - \bar{\pi} = pX - VC \qquad (12)$$

where VC are variable costs.

Maximization of the Nash product Ω w.r.t. ω, taking (9) and (12) into account, leads to an implicit solution for the gross hourly wage rate. An explicit specification for ω which is consistent with the framework outlined here has the following form: [for further details see Van Rompuy and De Bruyne (1988)].

$$\omega = \omega\left(h, G, \frac{Lp}{M}, \frac{Lg}{M}, \frac{pc}{1 - t_1}, \frac{\pi - \bar{\pi}}{Lp}, 1 + t_2, s, \omega_{-1}\right) \qquad (13)$$

$$- \quad ? \quad ? \quad + \qquad + \qquad + \qquad - \qquad - \qquad +$$

The lagged wage is used here as a proxy for strike compensation on which no time series data are available.

The expected signs are derived from an examination of the first order condition for a maximum of the Nash product. The negative sign for hours worked is based on the assumption that the income effect in the demand for leisure dominates. Public employment will affect wages in a positive sense since a rise in public employment will increase the share of the wage inelastic employment.

The impact of private employment is not straightforward since according to eq. (4), a larger share of private employment will increase utility loss of a wage increase. This negative impact may eventually dominate the positive income effect enjoined by the employed workers.

Higher direct taxes (t_1) and consumption prices are shifted forward into higher wages according to the specification of the utility function (1a). Profits per worker in the private sector have a positive impact on wages whereas the payroll tax will be shifted backward into lower wages. Social security benefits are a perfect substitute for wage income and bear therefore a negative sign. The sign of the public goods variable will depend on the substitutability between private income and public goods. Substitutability implies a negative sign whereas complementarity leads to a positive impact. Finally, the lagged wage as a proxy for strike compensation, has a positive impact since an increase in the lagged wage will build a higher threshold for future wage claims.

III. EMPIRICAL RESULTS

The period covered by the data runs from 1961 to 1985. Most data are drawn from the 'Maribel' databank organized by the Belgian Planning Office. Imported intermediate goods and raw materials (Z) and their price (p_z) have been derived from trade statistics. The endogenous wage and employment variables refer to the private sector of the Belgian economy.

Table 1 contains a subsample of the tax rates t_1 and t_2 as well as the tax wedge from the observation period. The tax wedge is defined as the difference between the yearly wage cost per worker and the yearly net of tax wage, expressed as a percentage of the latter. Note the sharp rise of the wedge from 1973 onward. The wedge increased dramatically in the eighties as a consequence of (i) an increase in the social security contributions and (ii) of the successive "indexation jumps". Social security contributions paid by employees were up to October 1982 limited to a maximum amount and were in fact degressive w.r.t. the wage bill. From 1983 onward, social security contributions were calculated as a fixed percentage of the wage earnings and were based on a proportional rate. The successive "indexation jumps" resulted in an increase of the cost of labour to the firm without a corresponding increase in the net of tax wage. This increase in the cost of labour was interpreted as equivalent to an increase in the payroll tax (t_2). As a consequence, the payroll tax rate increased between 1982 and 1985 by 35 per cent as compared to an increase of 12 per cent in the income tax rate (t_1) inclusive of social security contributions by workers.

TABLE 1
Tax Rates and the Tax Wedge

	t_1	t_2	Tax Wedge
1961	0.143281	0.158693	35,2 %
1964	0.152068	0.171312	38,1 %
1967	0.171293	0.189205	43,5 %
1970	0.198885	0.203146	50,2 %
1973	0.219421	0.219069	56,2 %
1976	0.254279	0.222776	64,0 %
1979	0.290345	0.221783	72,2 %
1982	0.314315	0.205294	75,8 %
1985	0.351798	0.276428	96,9 %

Source: Maribel, Planning Office.

The parameters of the two equation log-linear model which consists of the wage equation (11) and the private employment equation (5) have been estimated by means of the full information maximum likelihood method.

Table 2 contains the parameter estimates and the t-statistics. It appears that all parameters with exception of the constant in the employment equation are significantly different from zero and have the expected sign in sofar as the latter could be predicted.

An increase in the share of public employment (L^g/M) will lead to an increase in the nominal hourly wage (elasticity: 0.44). An increase in the share of private employment (L^p/M) will have the same but substantially larger effect (elasticity: 2.91).

An increase in the consumer price - income tax wedge ($p^c/1\text{-}t_1$) will be shifted forward into higher wages (elasticity: 0.69). An increase in the nominal profit differential per worker ($\pi - \bar{\pi}/L^p$) in the private sector will also push up wages (elasticity: 0.27). On the other hand, an increase in the payroll tax will be shifted backward into lower wages (elasticity: -2.30). It also appears that social benefits are considered as substitutes for wages since their elasticity is negative (-0.28). Public goods are, judging from the positive elasticity (0.10) complements to private income.

As for the employment equation, the product wage elasticity (-0.32) points to an inelastic demand for labour in the short run. One would conclude from the low and negative elasticity (-0.14) of employment with respect to the relative price of imported materials and energy (p_z/p) that labour and materials are weak complements.

Since this paper focuses on tax shifting, it is necessary to look closer at the tax elasticities of the wage rate. The elasticity of the wage rate with respect to the income tax rate, inclusive of social security contributions by workers, evaluated at sample means amounts to 0.21. This means that a 10 per cent increase in the rate t_1 will be shifted forward into a 2.1 per cent increase in the hourly wage. This wage impact will in the short run lead to a decrease in private employment by 0.68 per cent.

The elasticity of the wage with respect to the payroll tax rate (t_2) evaluated at sample means is estimated to be -0.39. This implies that a 10 per cent increase in the payroll tax rate will lead to a 3.9 per cent decrease in the hourly wage. The wage cost will however increase by 6.1 per cent which will in the short run result in a decrease of private employment by 1.95 per cent.

TABLE 2
Empirical results

Wage equation : ω		
Variable	Parameter estimate	t-statistics
constant	3.503	5.49
ln h	-1.142	-4.63
ln Lg/M	0.442	2.85
ln Lp/M	2.912	10.41
ln $Pc/(1-t_1)$	0.690	4.19
ln $(\pi - \bar{\pi})/Lp)$	0.275	3.95
ln $(1+t_2)$	-2.300	-5.98
ln ω_{-1}	0.601	5.90
ln s	-0.282	-3.19
ln G	0.097	3.79
Standard error of the regression = 0.017		
Durbin-Watson statistic = 1.805		
Employment equation : Lp		
Variable	Parameter estimate	t-statistics
constant	-1.546	-1.70
ln K	0.277	3.43
ln Pz/P	-0.141	-2.44
ln w/p	-0.322	-3.96
ln L^p - 1	0.941	10.83
Standard error of the regression = 0.011		
Durbin-Watson statistic = 1.408		

IV. CONCLUSION

This paper is a first attempt to analyse the process of tax shifting within an explicit wage bargaining model. The empirical evidence confirms the central role played by various taxes in the determination of wages. Increases in the income tax rate or in the social security contributions paid by employees are partially shifted forward into higher wages. Furthermore, the empirical results point to a partial backward shifting of higher payroll taxes. In both cases, the wage cost increases with a detrimental effect on employment, ceteris paribus.

These findings disclose a particular view on the causes of the poor Belgian macroeconomic performance from the mid seventies to the beginning of the eighties. A scenario of rising wage gaps and unemployment, low growth, a worsening of the current account and

mounting government deficits can indeed be the result of increased government expenditures which were partially financed through higher taxes on labour. Such a policy leads to higher wage costs, lower employment, a deterioration of profitability which negatively influences investment and growth, reduced international competitiveness affecting the export performance of the economy, and increased government deficits. This kind of self-inflicted stagnation has been documented by Knoester (1983) for some countries.

Clearly, the model as it stands cannot track all of these channels. We intend to enlarge and refine the model so that it can take into account the effects on capacity, on the current account and on the public sector deficit. Moreover, the analysis will be enriched if the assumption of perfect competition in the output market is abandoned in favour of price-setting firms operating in a market of monopolistic competition.

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